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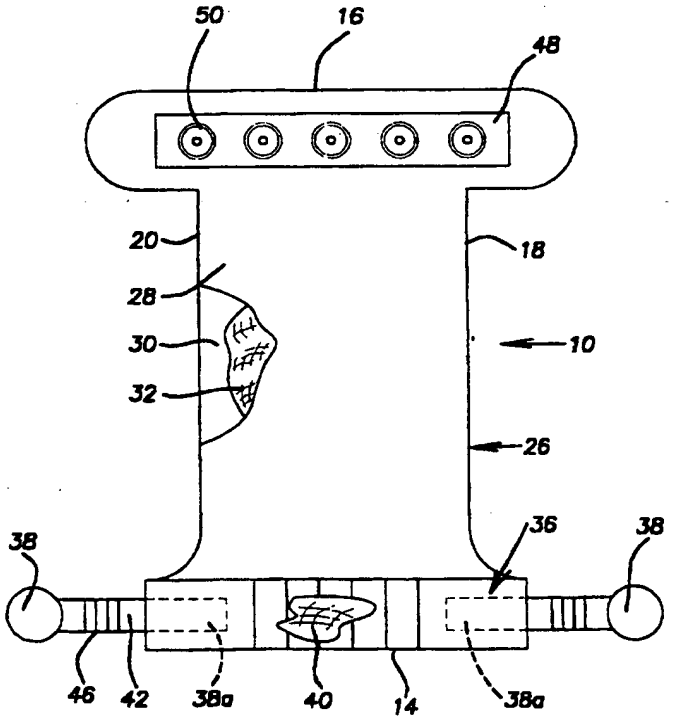
(54) Title: DISPOSABLE DIAPER WITH WAIST BELT STRUCTURE

(57) Abstract

A disposable diaper (10, 60, 80, 100, 120) includes a laminate (12) extending between first and second diaper ends (14, 16), and includes a waistband (34, 62, 82, 102, 122) adjacent the first diaper end (14) and a fastening system (38, 48, 66, 72, 86, 92, 106, 112, 126, 132) movable between an open and a closed position for releasably securing the diaper to a user. The waistband forms a tubular belt loop (36, 64, 84, 104, 124) extending along the first diaper end (14) to eliminate exposure of the edge or edges of the laminate (12) to the diaper user. The fastening system includes a fastener belt (38, 66, 86, 106, 126) mounted within each end of the waistband loop (36, 64, 84, 104, 124) by a factory joint (38a) whereby the tubular loop also eliminates exposure of the factory joints (380) to the diaper user. Mechanical (44, 44a, 50, 50b, 68, 70), mechanical/adhesive (88, 90, 108, 110, 128, 130) fastening or mechanical/cohesive (88, 90, 108, 110, 128, 130) fastening elements are carried by the fastener belts (58, 66, 86, 106, 126) and a diaper landing zone (48, 72, 92, 112, 132).



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DISPOSABLE DIAPER WITH WAIST BELT STRUCTURE

This application claims priority of US Provisional Application No. 60/012,347, filed February 27, 1996.

BACKGROUND OF THE INVENTION AND RELATED ART

The present invention relates to disposable diapers having a fastening system for closing the diaper about the user's body and, more particularly, to a disposable diaper having a complete waist belt structure and more convenient closure systems.

Diapers of this type are usually provided with a generally rectangular configuration and a layer construction. A typical diaper comprises an absorbent pad or batt or the like enclosed in a liquid impermeable outer backsheet and a liquid permeable inner top sheet. The backsheet may comprise a plastic film of polyethylene or a non-woven fabric laminated with a water impermeable layer such as a polyethylene film. The top sheet comprises a water permeable fabric or non-woven shell or liner that promotes separation of fluid from the user. The top sheet and the backsheet are sealed together along their overlying longitudinal edges, the opposed end edges being formed by cutting the layers and being unsealed.

The fastener tape system generally includes adhesive tabs fastened to one end of the diaper assembly construction at each lateral side of the diaper in a permanent "factory joint" by the diaper manufacturer using adhesives or other techniques. The tabs have a face coated with pressure-sensitive adhesive. The tabs are releasably attachable to the other end of the diaper at each lateral side in a "user joint". The attachment is releasable both to allow permanent removal of the diaper and to allow unfastening to inspect the diaper followed by refastening if indicated.

The user joint may be formed by direct connection of the tab to the diaper outer surface or backsheet whether the latter is formed of a plastic film or a non-woven. In the case of plastic films, it is typical to provide a "landing zone" formed of reinforcing tape or the like for receiving the end of the tab to form the user joint. The landing zone may provide a plastic surface or a nonwoven surface and may comprise a knit type fabric landing pad.

When the diaper is fitted to a baby, the fastener tabs typically extend from the longitudinal edges adjacent one end of the backsheet to the landing zone or area on the other lateral end of the backsheet that is positioned over the user's or baby's abdomen. Accordingly, the fastener tabs may be readily grasped by the baby and possibly pulled open.

The fastener tape system may rely solely upon pressure-sensitive adhesive in the formation of the user joint as shown in US Patents 4,795,456 4,710,190, 4,020,842 and 3,833,456. The use of combined adhesive and mechanical fastener systems is shown in US Patents 5,019,065, 5,053,028 and 4,869,724. The teachings of all of these patents being incorporated herein by reference.

The use of extensible or stretchable tabs to promote user comfort through better fit and more secure mounting is also known in the art. The tabs operate as extensible diaper side waistbands. Examples of such diaper fastening systems are disclosed in US Patents 4,795,456, 4,066,081, 4,051,853 and 3,800,796.

Related art includes US Patents 2,499,898, 2,548,004, 3,038,225, 3,064,268, 3,089,494, 3,454,993, 4,189,809, 4,880,421, 5,097,570, 5,119,531, 5,345,659, 5,440,787 and 5,545,159.

SUMMARY OF THE INVENTION

The present invention contemplates diaper constructions including a substantially complete waistband. The waistband provides improved comfort and more uniform securement tension to the baby with accompanying improvements in sealing.

The waistband construction combines fastener belts with a continuous waistband adjacent each end of the diaper. The belts are secured by a factory joint to the diaper within opposed ends of the waistband. Upon closure of the diaper, a substantially complete waistband effect is achieved.

The waistband is formed with closed upper edges that are more comfortable and less irritating to the baby's skin as compared with the prior art unsealed open ends and exposed layer edges. Similarly, the waistband conceals the factory joints that secure the fastener belts to the diaper. The waistband may be provided with a soft filled construction to further enhance the baby's comfort and the sealing of the diaper contents.

The waistband also includes several mechanical closure systems that are more conveniently manipulated than the prior art adhesive fastener tapes or hook/loop type tabs. Also, the relatively larger dimensions of the mechanical engaging elements of the invention substantially reduce, if not eliminate, the prior art problems involving crushing the hooks/loops during manufacture or processing, especially in roll manipulation. Certain of the closures combine both mechanical and adhesive or cohesive engagement to further improve the security of the diaper closure.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view showing a diaper having a waistband in accordance with the invention, the diaper being shown in a flat condition;

Fig. 2 is a schematic fragmentary perspective view showing the waistband of the diaper of Fig. 1 in a configuration if fitted to an infant and having one of the fastener belts engaged and one opened;

Fig. 3 is a fragmentary perspective view on an enlarged scale showing the closure system of the waistband of the diaper of Fig. 1;

Fig. 4 is a perspective view similar to Fig. 2 showing a second embodiment of a waistband in accordance with the invention;

Fig. 5 is fragmentary sectional view on an enlarged scale showing the closure system of the waistband of the diaper of Fig. 4;

Fig. 6 is a perspective view showing a diaper having a waistband in accordance with another embodiment of the invention, the waistband being shown in the open condition;

Fig. 7 is a perspective view similar to Fig. 6 showing the diaper of Fig. 6 with the waistband in a closed position;

Fig. 8 is a fragmentary perspective view on an enlarged scale showing the closure system of the waistband of the diaper of Fig. 6;

Fig. 9 is a perspective view showing a diaper having a waistband in accordance with a further embodiment of the invention, the diaper being shown in a flat condition;

Fig. 10 is a schematic fragmentary perspective view showing the waistband of the diaper of Fig. 9 in a configuration as if fitted to an infant and having one of the fastener belts engaged and one opened;

Fig. 11 is a schematic perspective view of an alternative closure for use in the waistband of Fig. 9;

Fig. 12 is a schematic fragmentary perspective view showing a diaper having a waistband in accordance with another embodiment of the invention, the diaper being shown in a configuration as if fitted to an infant and having both of the fastener belts opened;

Fig. 13 is a schematic perspective view on an enlarged scale of the waistband of the diaper shown in Fig. 12 with the fastener belts engaged; and

Fig. 14 is a schematic perspective view showing a roll supply of the faster belt of the waistband of the diaper of Fig. 12.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring to Fig. 1, a disposable diaper 10 comprises a laminate or layered assembly 12. The diaper 10 has a generally I-shape configuration including a first end 14 and a second end 16 connected by longitudinally extending edges 18 and 20. The diaper 10 includes a back portion 22 and a front portion 24 connected by an intermediate portion 26.

The diaper 10 has a backsheet 28, a top sheet 30 and an absorbent core or pad 32. The top sheet 28 and backsheet 30 are sealed together along the longitudinal edges 22 and 24 of the diaper.

The top sheet 28 may be formed of liquid-permeable, substantially hydrophobic material, such as a spun bonded web of synthetic filaments. The backsheet 30 may be a thin sheet or film of polyolefin material as is well known in the art. The core 26 may comprise a liquid retaining pad of hydrophilic fibers, such as cellulosic fibers commonly referred to as fluff, possibly blended with synthetic polyolefin fibers.

The diaper 10 includes a waistband or waistbelt assembly 34 comprising an essentially tubular belt support loop 36 having opposed fastener belts 38 mounted at each open end thereof in a permanent factory joint 38a. The loop 36 may be formed by an extension of the backsheet 28 or the top sheet 30 or by a separate strip portion secured to the adjacent edges of the sheets 28 and 30. In each such arrangement, the diaper 10 is provided with a closed end 14 that does not expose the infant user to irritating cut edges of plastic or other laminate materials.

The loop 36 may include soft filler such as polymeric foam, cellulosic tissue, fiberous padding or other fluffy material to provide further comfort and enhanced sealing against the baby's body. The loop 36 is thereby provided with a filled and pleated appearance adding to the attractiveness of the diaper.

The fastener belt 38 includes a mounting portion 42 and an engaging portion 44 including snap nubs 44a (Figs. 2 and 3). In order to assure sufficient flexibility and extensibility in the belt construction, the mounting portion 42 is shirred with the use of corrugations or flutes 46 formed therein. The corrugations 46 may be formed during the molding or stamping of the belt or in other conventional manners. The belt is formed of a sufficiently strong material to allow tensioning of the waistband. The belt may be formed of conventional diaper construction materials such as polypropylene, polyester, polyethylene and nylon as well as blends and copolymers.

A landing zone 48 is permanently mounted to the backsheet 28 of the diaper adjacent the end 16. As shown in Figs. 1-3, the landing zone 48 comprises an array of recesses 50 having openings 50b sized to resiliently and matingly receive the snap nubs 44a on the fastener belt 36. The convex and concave surfaces of the engaging

portions 44 and 50 are substantially larger than the cross-sectional areas of the snap nubs 44b and openings 50b. The landing zone 48 may be formed of a low density polyethylene material having the recesses formed therein by heat stamping.

Referring to Fig. 2, the waist belt assembly 34 is shown in a fitted configuration wherein the landing zone 48 is disposed between the belts 38 for engagement therewith. The belt 38 at the right side of the diaper 10 is shown engaged with one of the recesses 50 and the belt 38 at the left side of the diaper is open for tensioning prior to engagement.

Referring to Fig. 4, a diaper 60 of the same general construction as the diaper 10 is provided with a waistband or waist belt assembly 62. The waist belt assembly 62 includes a tubular belt support loop 64 and opposed fastener belts 66. The waist belt assembly 62 is similar to the waist belt assembly 34 in all major respects except for the closure system as described below.

The belts 66 are formed of flexible polymeric diaper construction materials and include an array nubs 68 adapted to interlock with a similar array of depressions 70 provided in the landing zone member 72. The nubs 68 and depressions 70 are surrounded by substantially flat or planar belt surfaces adapted to be disposed in overlying contiguous engagement when the fastener is closed.

Referring to Fig. 5, the nubs 68 are sized to be received with a resilient fit in the depressions 70. Upon engagement, a very strong closure is obtained since a relatively large number of interlocks are formed. The nubs 68 may range in diameter size from 1/32" to 3/8".

The belts 66 and landing zone member 68 may be formed of conventional diaper construction materials such as polyethylene, polypropylene, polyester or nylon. These materials may be shaped using conventional molding, extrusion and casting processes.

Referring to Fig. 6, a diaper 80 of the same general construction as the diaper 10 is provided with a waistband or waist belt assembly 82. The waist belt assembly 82 includes a tubular belt support loop 84 and opposed fastener belts 86. The belts 86 are shown in an open condition in Fig. 6 and in a closed condition in Fig. 7. The waist belt assembly 82 is similar to the waist belt assembly 34 in all major respects except for the closure system as described below.

The belts 86 are formed with a corrugated surface portion 88 adapted to interlock with a similar corrugated surface portion 90 provided by the landing zone 92 as best shown in Fig. 8. The belts 86 and landing zone member 88 may be formed of conventional diaper construction materials such as polyethylene, polypropylene, polyester or nylon. These materials may be shaped using conventional molding, extrusion and casting processes.

The interlocked corrugated surface portions 88 and 90 provide the equivalent of adhesive shear strength. In order to further enhance the closure strength, the surface portions 88 may be coated with a pressure-sensitive adhesive. The pressure-sensitive adhesive may be acrylic or rubber based pressure-sensitive adhesives. Preferred adhesives include hot melt adhesives such as the adhesives taught in US Patent 3,932,328. Alternatively, both surface portions 88 and 90 may be coated with a cohesive material. Useful cohesives are disclosed in US Patent 5,085,655. The tack strength

provided by the adhesive or cohesive materials prevents the closure from unexpectedly opening.

Referring to Figs. 9 and 10, a diaper 100 of the same general construction as the diaper 10 is provided with a waistband or waist belt assembly 102. The waist belt assembly 102 includes a tubular belt support loop 104 and opposed fastener belts 106. The belt 106 on the right side of the diaper is shown in a closed condition and the left belt 106 is shown in an open condition in Fig. 10. The waist belt assembly 102 is similar to the waist belt assembly 34 in all major respects except for the closure system as described below.

The belts 106 are formed with an array of convex protruding members 108 adapted to interlock with a similar array of concave receiving members 110 provided by the landing zone 112 as best shown in Fig. 11. The belts 106 and landing zone member 112 may be formed of conventional diaper construction materials such as polyethylene, polypropylene, polyester or nylon. These materials may be shaped using conventional molding, extrusion and casting processes.

The interlocked surfaces of the members 108 and 110 provide the equivalent of adhesive shear strength. In order to further assure the closure, the surfaces of the members 108 may be coated with a pressure-sensitive adhesive. The pressure-sensitive adhesive may be acrylic or rubber based pressure-sensitive adhesives. Preferred adhesives include hot melt adhesives such as the adhesives taught in US Patent 3,932,328. Alternatively, the surfaces of both members 108 and 110 may be coated with a cohesive material. Useful cohesives are disclosed in US Patent 5,085,655. The tack strength provided by the adhesive or cohesive materials prevents the closure from unexpectedly opening.

The members 108 and 110 are generally ellipsoid in shape and may range in size from 1/8" to 1/2" in diameter along the short diameter, the long diameter being about 1" long. Of course, it should be appreciated that the convex and concave members may have a variety of shapes such as spherical, conical or box-like.

Referring to Figs. 12, 13 and 14, a diaper 120 of the same general construction as the diaper 10 is provided with a waistband or waist belt assembly 122. The waist belt assembly 122 includes a tubular belt support loop 124 and opposed fastener belts 126. The belts 126 are shown in an open condition in Fig. 12 and in a closed condition in Fig. 13. The waist belt assembly 122 is similar to the waist belt assembly 34 in all major respects except for the closure system as described below.

Each of the belts 126 is provided with one or more rigid tab members 128 having a flat configuration and being slightly spaced from the surface of the belt to which it is mounted and has a pivotal type connection to the belt. The tab member 128 has a guitar pick shape including a tapered trailing end. The member 128 is adapted to be received in a slot opening 130 provided by landing zone member 132. As shown, a plurality of slot openings 130 may be provided to allow for size adjustment of the diaper upon closure. The slot openings 130 should be formed of a material sufficiently strong to resist the loads imposed by the member 128.

As indicated above, a plurality of members 128 may be provided at spaced locations along the length of the belt 126. The members 128 may range in length, width and thickness from about 1" x 1" x 1/8" to 1/64" x 1/64" x 0.001". It is also possible to arrange the members 128 in side-by-side relationship on the belt 128. In the later case, smaller sizes must be used.

The closure may be further enhanced by the use of a pressure-sensitive adhesive layer 134 which adheres to the landing zone 132 to inhibit disengagement movement of the member 128.

Cohesives may also be used if applied to both the belt 126 and the landing zone 132. The above described adhesives and cohesives may be used.

It should be evident that this disclosure is by way of example and that various changes may be made by adding, modifying or eliminating details without departing from the fair scope of the teaching contained in this disclosure. The invention is therefore not limited to particular details of this disclosure except to the extent that the following claims are necessarily so limited.

WHAT IS CLAIMED IS:

1. A disposable diaper comprising a layered assembly extending between first and second diaper ends connected by opposed longitudinal edges, waist band means adjacent said first diaper end and a fastening system movable between an open and a closed position for releasably securing said diaper to a user, said layered assembly comprising a laminate of generally rectangular laminate members including a liquid permeable top sheet, a liquid impermeable backsheet, and an absorbent pad intermediate the top sheet and backsheet, said laminate members extending to at least one edge adjacent said first diaper end, said waist band means forming a tubular belt loop extending along said first diaper end to eliminate exposure of said at least one edge of said laminate member to said diaper user, said tubular belt having spaced first and second ends respectively positioned adjacent associated ones of said longitudinal edges of said diaper, said fastening system including a fastener belt mounted at each end of the waist band loop, each of said fastener belts extending from a mounting portion within said tubular loop to an engaging portion extending from said tubular loop, said mounting portion being fixed to said diaper by a user joint enclosed within said tubular loop, and said tubular loop thereby also eliminating exposure of said factory joint to said diaper user.

2. A diaper as in claim 1, wherein said tubular loop extends from one of said longitudinal edges to the other of said longitudinal edges.

3. A diaper as in claim 1, wherein said fastening belt has a length extending laterally between said longitudinal edges and a width extending longitudinally in alignment with said longitudinal edges, said mounting and engaging portions being positioned at spaced locations along the length of said fastening belt, said tubular loop having a flattened shape and a longitudinally extending major opening dimension substantially corresponding in size with the width of said fastening belt.

4. A diaper as in claim 3, wherein said tubular loop includes soft filler to further enhance user comfort and sealing against the user's body.

5. A diaper as in claim 4, wherein said fastener belts include extensibility means for resiliently fastening said diaper about the user.

6. A diaper as in claim 5, wherein said extensibility means include corrugations in said mounting portions of said fastening belts.

7. A diaper as in claim 1, wherein said engaging portion includes a first fastening means engageable with a second fastening means carried by a landing zone fixed to said second diaper.

8. A diaper as in claim 7, wherein said first fastening means comprises a first mechanical fastening element positioned adjacent said engaging portion of each of said fastening belts, said second fastening means comprises a second mechanical fastening element carried by said landing zone, said first and second fastening elements each including engaging surface means including

mating surfaces having contiguous engagement surface portions and mechanically interlocking surface portions, said contiguous engaging surface portions being substantially larger than said mechanically interlocking surface portions.

9. A diaper as in claim 7, wherein said first fastening means comprises a first mechanical fastening element positioned adjacent each end of said engaging portion of said fastening belt, said first fastening element including a convex disc-shaped engaging surface having a centrally located and protruding snap nub, said second fastening means comprises a plurality of second mechanical fastening elements carried by said landing zone, said second fastening element including a concave disc-shaped engaging surface having a centrally located aperture for resiliently receiving said snap nub, said convex and concave disc-shaped engaging surfaces being similarly curved to matingly engage as said snap nub is received in said aperture.

10. A diaper as in claim 9, wherein said convex and concave disc-shaped engaging surfaces having similarly sized areas, said snap nub and aperture having similarly sized cross-sectional areas, said areas of said convex and concave disc-shaped engaging surfaces being substantially greater than the cross-sectional areas of said snap nub and aperture.

11. A diaper as in claim 10, wherein said landing zone includes five concave disc-shaped engaging surfaces spaced along said second end of said diaper.

12. A diaper as in claim 11, wherein said tubular loop extends from one of said longitudinal edges to the other of said longitudinal edges, said fastening belt has a length extending laterally between said longitudinal edges and a width extending longitudinally in alignment with said longitudinal edges, said mounting and engaging portions being positioned at spaced locations along the length of said fastening belt, said tubular loop having a flattened shape and a longitudinally extending major opening dimension substantially corresponding in size with the width of said fastening belt.

13. A diaper as in claim 7, wherein said first fastening means comprises a first mechanical fastening element positioned adjacent said engaging portion of each of said fastening belts, said first fastening element including a first flat engaging surface having a plurality of projecting snap nubs, said second fastening means comprising a second mechanical fastening element carried by said landing zone, said second fastening element comprising a second flat engaging surface having a plurality of apertures for resiliently receiving said snap nubs, said first and second engaging surfaces being substantially contiguously superposed when to said snap nubs are received in said apertures.

14. A diaper as in claim 13, wherein said snap nubs and apertures are each arranged in a similar array, said array of aperture extending along said second end of said diaper.

15. A diaper as in claim 13, wherein said snap nubs have diameters in the range of from about 1/32" to about 3/8".

16. A diaper as in claim 15, wherein said tubular loop extends from one of said longitudinal edges to the other of said longitudinal edges, said fastening belt has a length extending laterally between said longitudinal edges and a width extending longitudinally in alignment with said longitudinal edges, said mounting and engaging portions being positioned at spaced locations along the length of said fastening belt, said tubular loop having a flattened shape and a longitudinally extending major opening dimension substantially corresponding in size with the width of said fastening belt.

17. A diaper as in claim 7, wherein said first fastening means comprises a first mechanical fastening element positioned adjacent said engaging portion of each of said fastening belts, said first fastening element including a first corrugated surface having a plurality of alternating first ridges and grooves, said second fastening means comprising a second mechanical fastening element carried by said landing zone, said second fastening element comprising a second corrugated surface having a plurality of alternating second ridges and grooves, said first and second ridges and grooves being similarly sized for mating interengagement in overlying relationship upon closure of said fastening system, and contact securement means disposed along at least one of said first and second corrugated surfaces, said contact securement means providing tack strength and said interengagement of said overlying corrugated surfaces providing shear strength when said fastening system is in said closed position.

18. A diaper as in claim 17, wherein said contact securement means comprises a layer of pressure-sensitive adhesive disposed along said second corrugated surface.

19. A diaper as in claim 17, wherein said contact securement means comprises a layer of cohesive disposed along each of said corrugated surfaces.

20. A diaper as in claim 17, wherein said tubular loop extends from one of said longitudinal edges to the other of said longitudinal edges, said fastening belt has a length extending laterally between said longitudinal edges and a width extending longitudinally in alignment with said longitudinal edges, said mounting and engaging portions being positioned at spaced locations along the length of said fastening belt, said tubular loop having a flattened shape and a longitudinally extending major opening dimension substantially corresponding in size with the width of said fastening belt.

21. A diaper as in claim 7, wherein said first fastening means comprises a first mechanical fastening element positioned adjacent said engaging portion of each of said fastening belts, said first fastening element including at least one convex engaging surface, said second fastening means comprises a second mechanical fastening element carried by said landing zone, said second fastening element including a plurality of concave engaging surfaces, said convex and concave engaging surfaces being similarly curved to matingly engage upon closure of said fastening system.

22. A diaper as in claim 21, wherein said fastening system also includes contact securement means disposed along at least one of said first and second engaging surfaces, said contact securement means providing tack strength and said mating engagement of said engaging surfaces providing shear strength when said fastening system is in said closed position.

23. A diaper as in claim 21, wherein said contact securement means comprises a layer of adhesive disposed along said first engaging surfaces.

24. A diaper as in claim 21, wherein said contact securement means comprises a layer of cohesive disposed along each of said engaging surfaces.

25. A diaper as in claim 21, wherein said engaging surfaces have an ellipsoid shape, and have a major diameter of about 1" and a minor diameter of from about 1/8" to about 1/2".

26. A diaper as in claim 21, wherein said tubular loop extends from one of said longitudinal edges to the other of said longitudinal edges, said fastening belt has a length extending laterally between said longitudinal edges and a width extending longitudinally in alignment with said longitudinal edges, said mounting and engaging portions being positioned at spaced locations along the length of said fastening belt, said tubular loop having a flattened shape and a longitudinally extending major opening dimension substantially corresponding in size with the width of said fastening belt.

27. A diaper as in claim 7, wherein said first fastening means comprises a first mechanical fastening element positioned adjacent each end of said engaging portion of said fastening belt, said first fastening element including at least rigid flat member pivotally connected to said fastening belt, said second fastening means comprises a second mechanical fastening element carried by said landing zone, said second fastening element including a plurality of openings for receiving said flat members, said flat members being engaged within associated openings when said fastening system is in said closed position.

28. A diaper as in claim 27, wherein said fastening system also includes contact securement means disposed either said engaging portions of said fastener belts or said landing zone.

29. A diaper as in claim 28, wherein said contact securement means comprises a layer of adhesive disposed along said engaging portions of said fastening belts.

30. A diaper as in claim 21, wherein said contact securement means comprises a layer of cohesive disposed along each of said engaging portions of said fastening belts and said landing zone.

31. A diaper as in claim 21, wherein said first fastening means comprises a first mechanical fastening element positioned adjacent each end of said engaging portion of said fastening belt, said first fastening element including at least rigid flat member pivotally connected to said fastening belt, said second fastening means comprises a second mechanical fastening element carried by said landing zone, said second fastening

element including a plurality of openings for receiving said flat members, said flat members being engaged within associated openings when said fastening system is in said closed position.

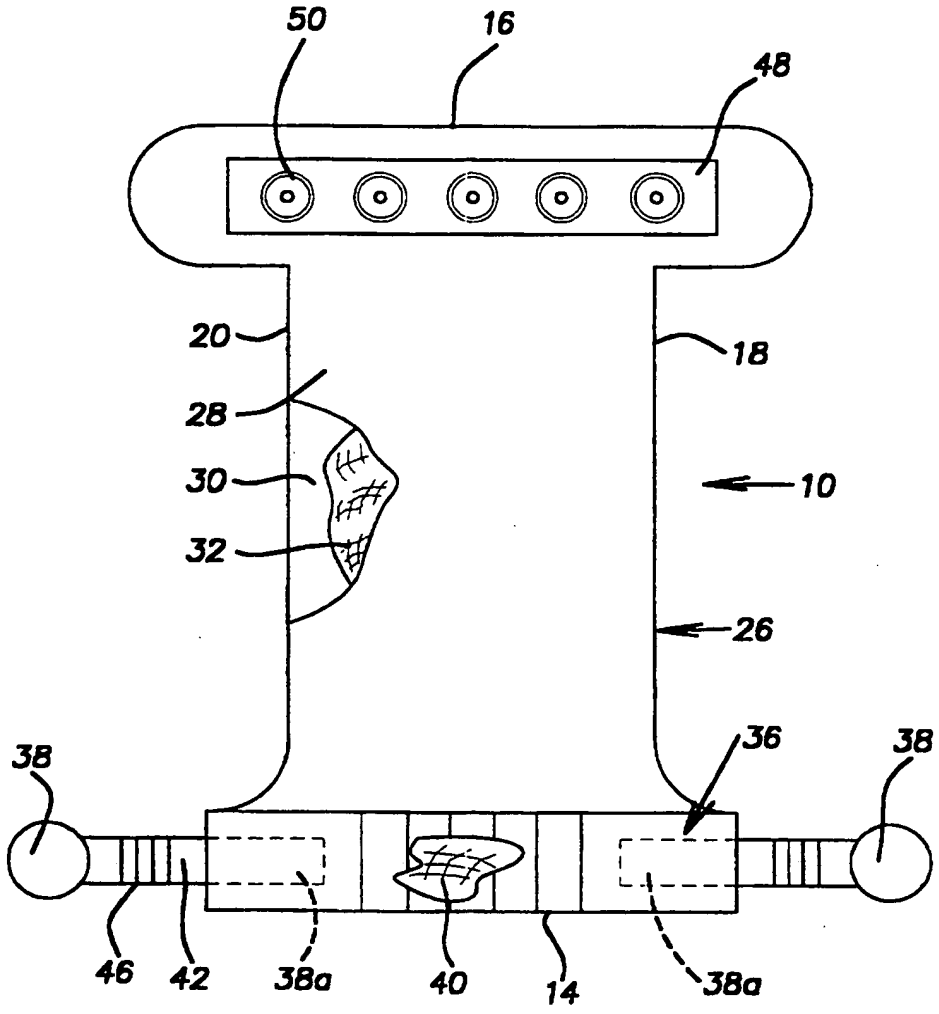

Fig.1

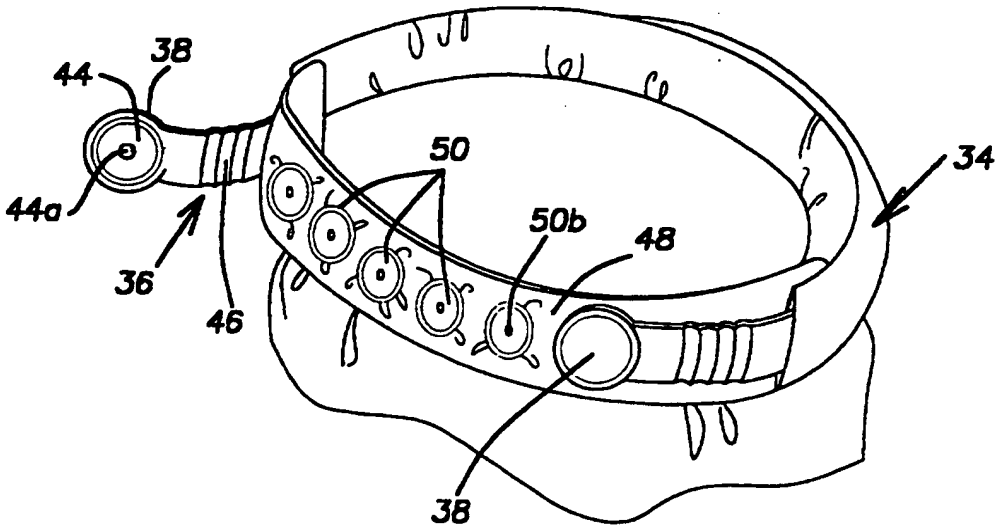

Fig.2

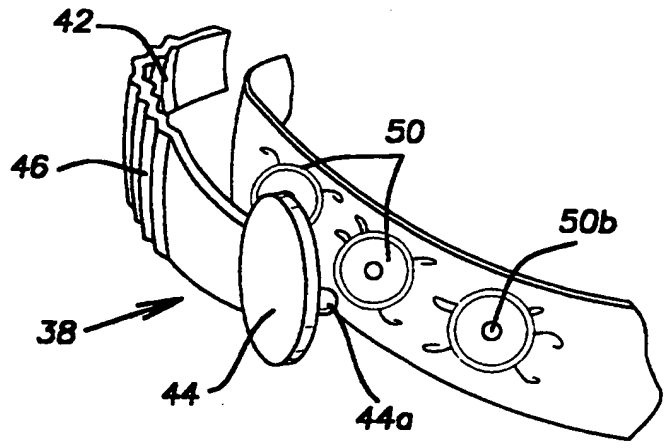

Fig.3

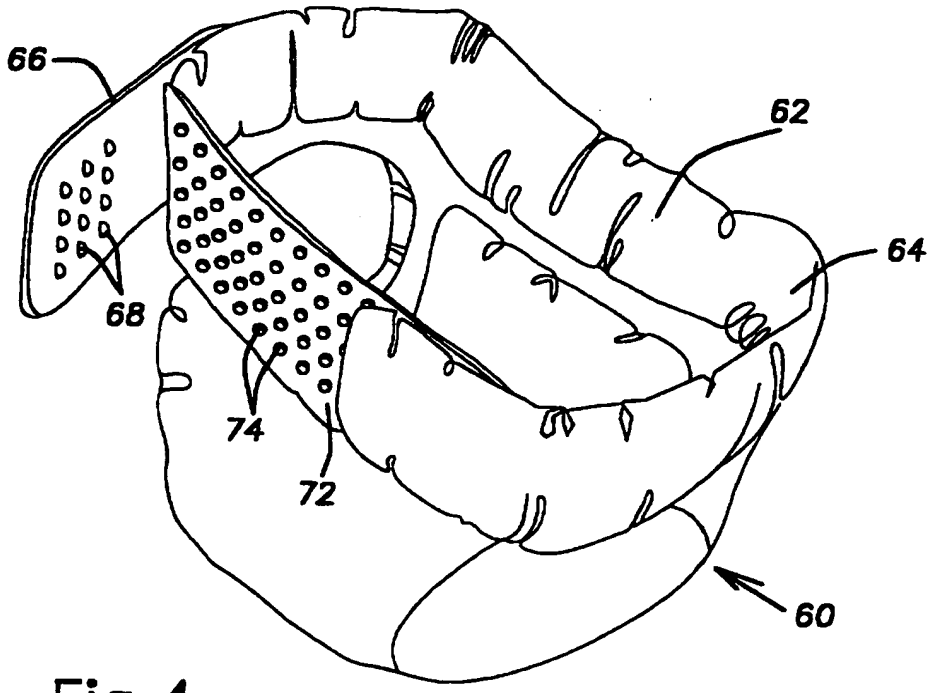

Fig.4

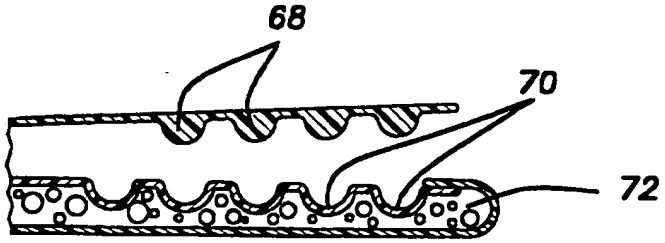

Fig.5

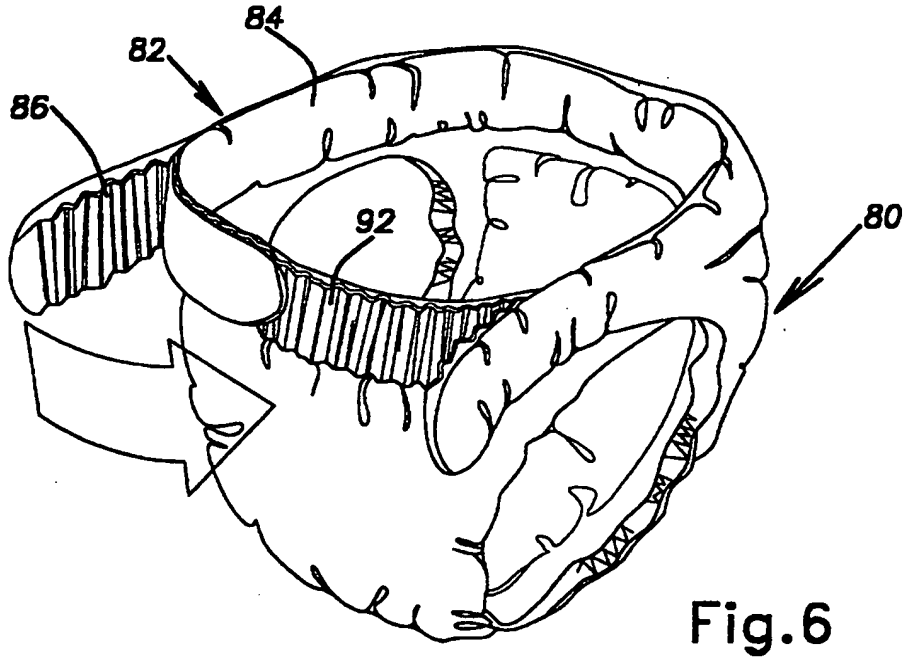

Fig.6

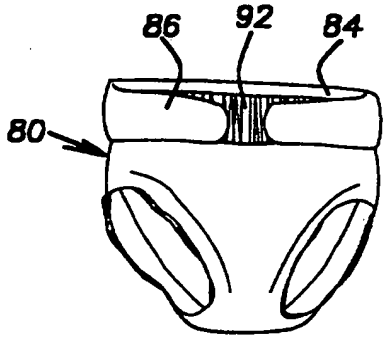

Fig.7

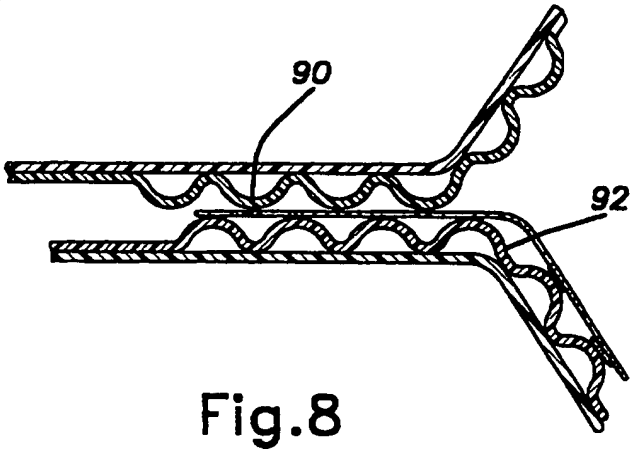

Fig.8

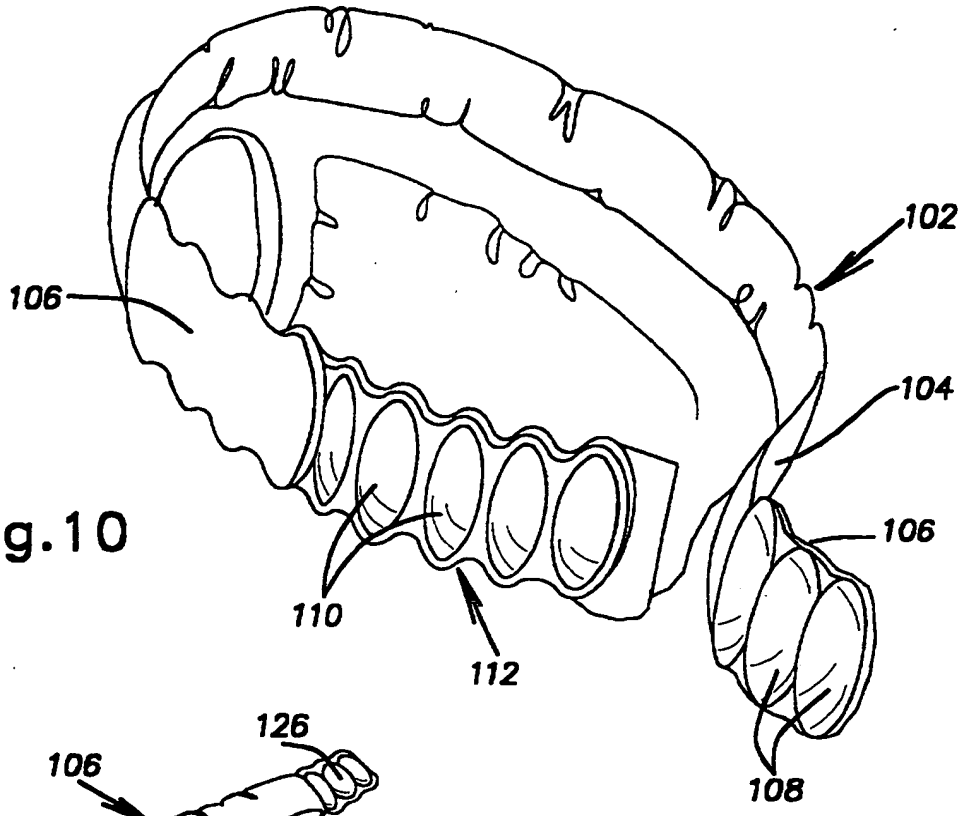

Fig.10

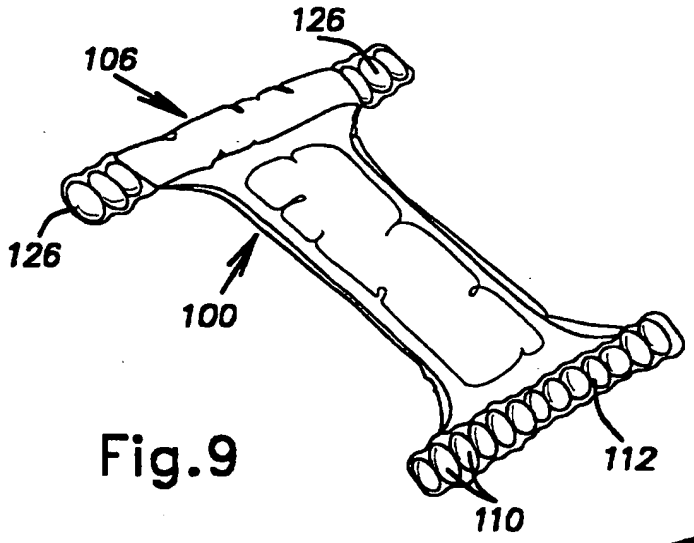

Fig.9

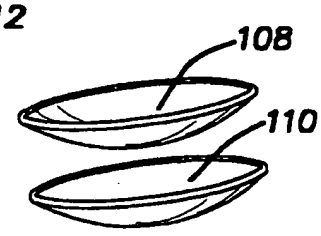

Fig.11

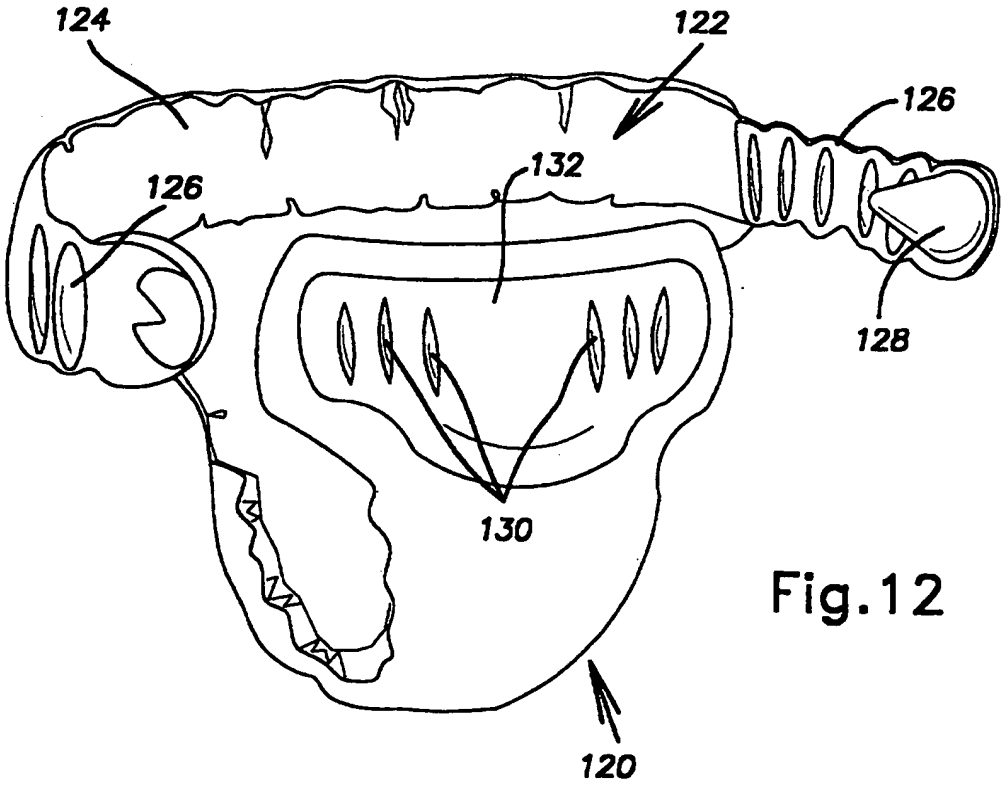

Fig.12

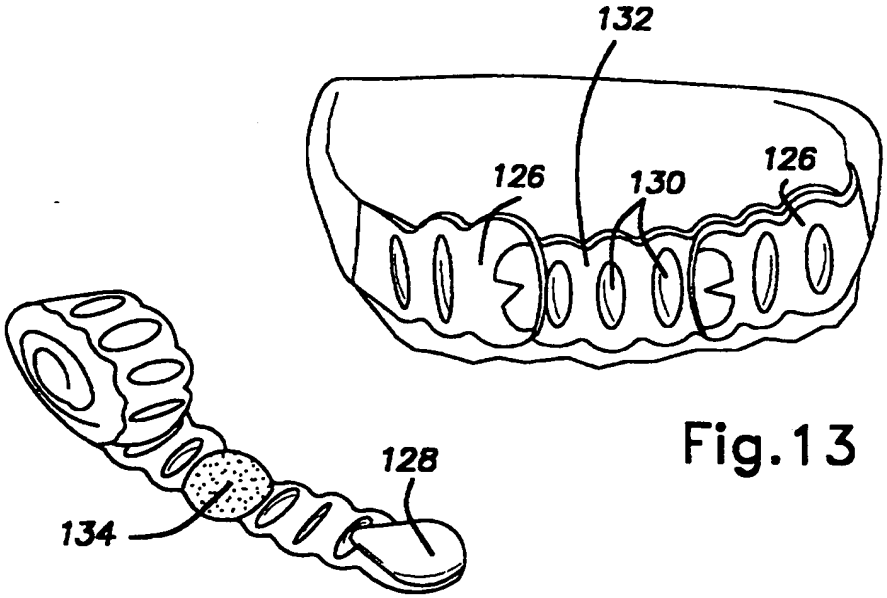

Fig.13

Fig.14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/03008

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :A61F 13/15

US CL :604/385.1, 385.2, 386, 389-392

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 604/385.1, 385.2, 386, 389-393

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4,670,012 A (JOHNSON) 02 June 1987, figures.	1, 5, 6
A	US 5,221,276 A (BATTRELL) 22 June 1993, figures.	1, 7, 13-19, 21-25, 27-30
A	US 5,269,776 A (LANCASTER et al) 14 December 1993, figures.	1-3, 7, 8, 12-31
A	US 2,606,558 A (KENNETTE) 12 August 1952, Fig. 5.	8-11

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 15 APRIL 1997	Date of mailing of the international search report 25APR 1997
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer Diane K Smith for KARIN M. REICHLE Telephone No. (703) 308-2617

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